

HyUnder Project



(Grant Agreement nº 303417)

Assessment of the potential, the actors and relevant business cases for large scale and seasonal storage of renewable electricity by hydrogen underground storage in Europe

FCH JU Review Days 2012

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1. Project achievements: Project & Partner Description



- **HyUnder**, Assessment of the potential, the actors and relevant business cases for large scale and seasonal storage of renewable electricity by hydrogen underground storage in Europe (www.hyunder.eu)
- Duration 24 months, from 18/06/2012 to 17/06/2014
- Budget: 1.766.516 € / Funding: 1.193.273 €
- 12 project partners from 7 countries (D, F, UK, ES, NL, RO, B):
 - 7 institutes or consultants,
 - 3 large industry,
 - 2 SMEs.
 - Six members from RG or IG.



1. Project achievements:

Background



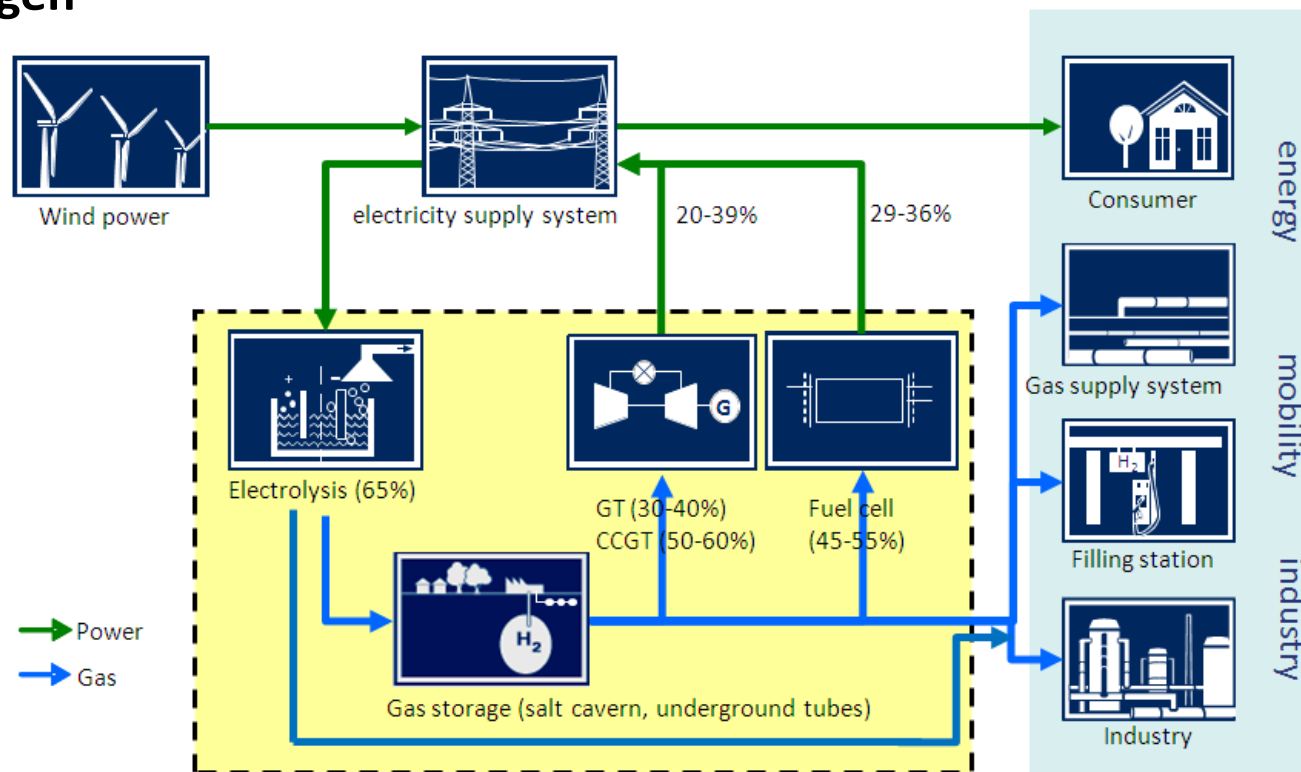
Why storing large scale intermittent renewable energies with hydrogen?

- Increasing **fluctuating renewable energy** in the long run → **need for electricity storage** to ensure **network reliability and flexibility**.
- Large scale underground gas storage: **relatively mature solution** (economic and technical)
- Thorough evaluation of hydrogen underground storage needed from a technical, economic and societal standpoint, providing understanding of:
 - potential economic returns for **investors**;
 - technical attractiveness for **network operators and energy producers**;
 - potentially addressable markets for **technology developers**;
 - benefits for the society as a whole, and how environmental risks are being evaluated and addressed for **policy makers and citizens**.

1. Project achievements: Vision



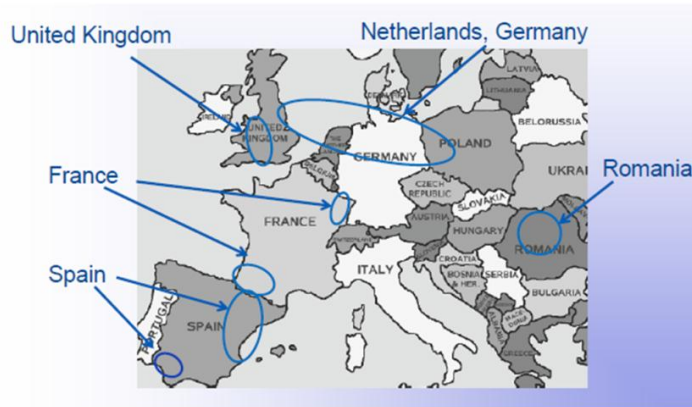
Electricity-to-gas for re-electrification, as transport fuel and for material use: E-Hydrogen



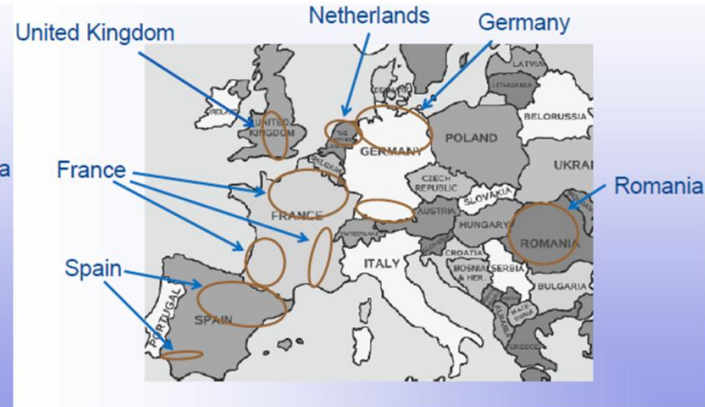
1. Project achievements: Project Goals



Storage potential in salt formations



Storage potential in depleted gas fields and Aquifers

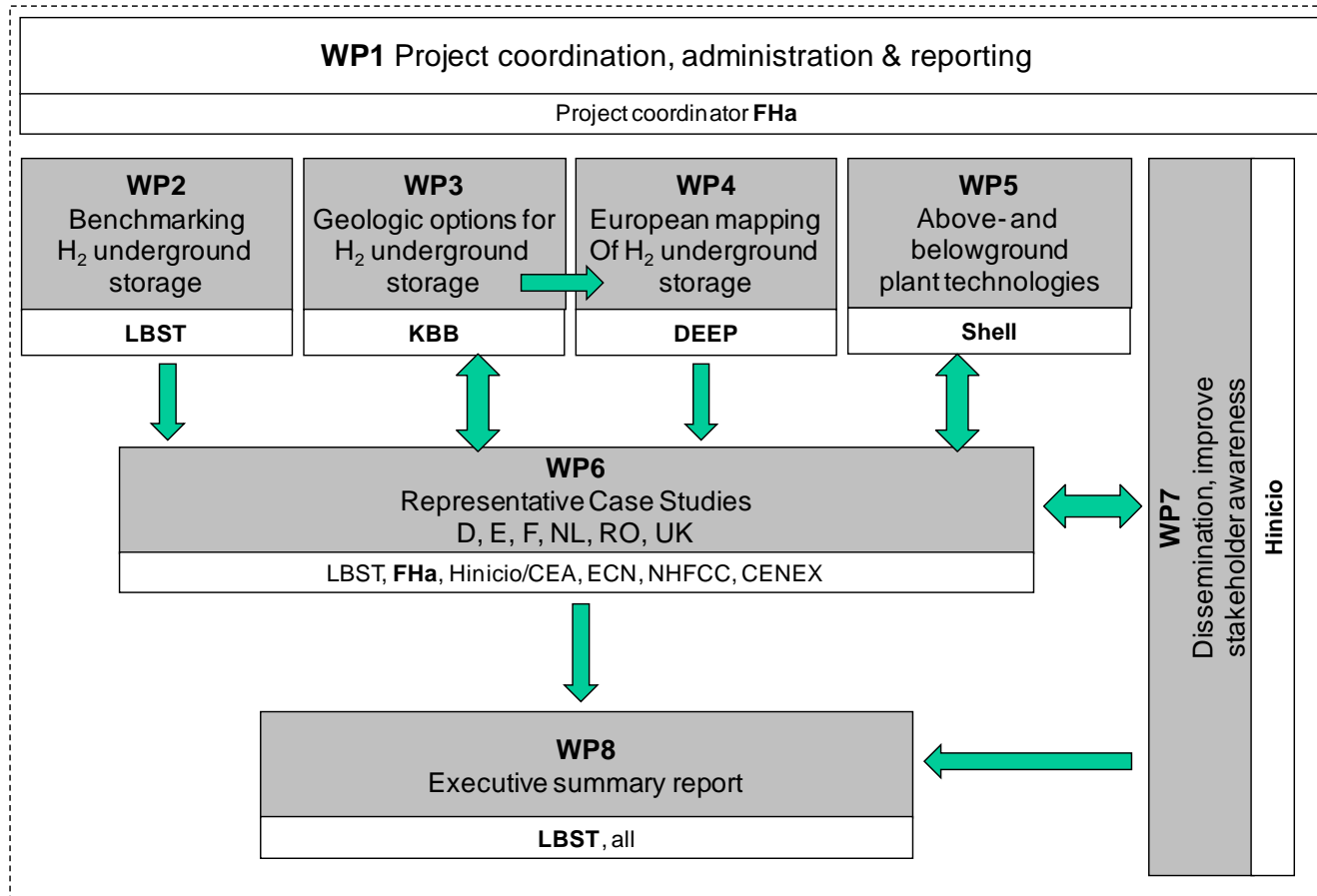


Source: DEEP Underground Engineering

HyUnder will:

- Document the current state of large-scale hydrogen underground storage against other **competing concepts**.
- Assess the various **geologic options** for hydrogen underground storage.
- Analyze the below and above ground **plant and process technology** required for **safe operation** of the hydrogen underground storage plant.

1. Project achievements: Targets and Approach

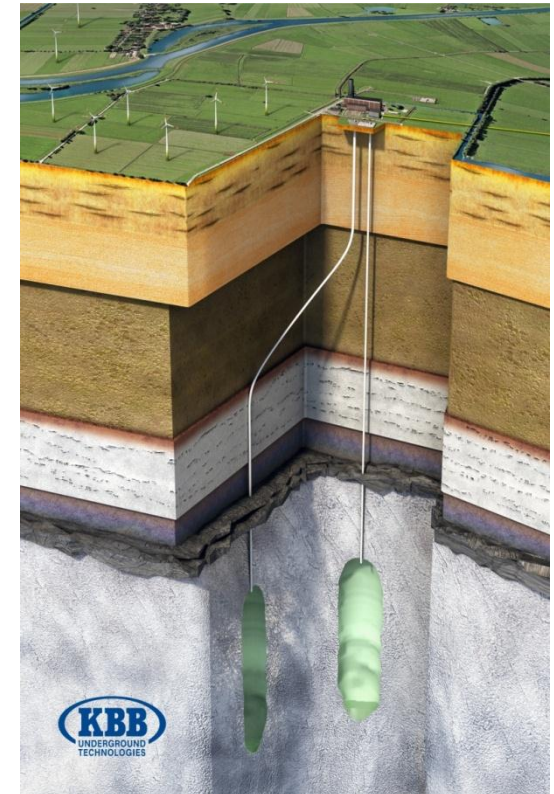


1. Project achievements: Targets and Approach



European Case Studies

- Development of individual case studies on hydrogen underground storage for **Germany, Spain, the UK, Romania, France and the Netherlands**, all based on a common methodology:
 - Regional storage prototype location analysis
 - Economic scenario type assessment,
 - Introduction of hydrogen into different markets.
 - Sensitivity analysis based on scenarios assumptions.
 - Comparison of the results of the individual case studies.



2. Alignment to MAIP/AIP



Correlation to FCH JU Multi Annual Implementation Plan – MAIP:

- **Quantitative targets MAIP for 2020:** 4,000 tons capacity, 0.006 M€/ton.
- **Priorities of the MAIP application areas – Hydrogen Production & Distribution**
 - **“demonstration** of technology options for high volume, safe hydrogen storage such as **storage in underground caverns** and decentralized storage, in synergy with the energy storage requirements resulting from the **variability and intermittency of renewable energy sources** connected to the electricity grid.
- **Long term vision**
 - **“In the 2050 vision, [...] hydrogen will be used as an “energy buffer” [...] integrating large volumes of renewable energy in the energy system.”**
- **One of the priority topics for the FCH JU: namely H07**

2. Alignment to MAIP/AIP



Correlation to Annual Implementation Plan 2011 (AIP 2011):

- **Programme Overview – Cross Cutting issues**
 - “ensure that **non-technical barriers** to the deployment of these technologies are properly addressed”.
- **Specific topic, scope**
 - “Study to assess the potential use of hydrogen as an energy storage medium in **energy markets**. The topic looks at the potential integration of hydrogen with renewable energy sources and will establish the **conditions under which this option is advantageous**”.
- **Topic SP1-JTI-FCH.2011.5.1, Rationale**
 - “So far, hydrogen is systematically **less favoured** as a potential solution against other possibilities [...] because of its **lower round trip efficiency**”
 - “highlight the advantages of hydrogen [...] taking into account [...] the **limited capacities for conventional storage** options”.

2. Alignment to MAIP/AIP



Correlation to Annual Implementation Plan 2011 (AIP 2011):

- **Topic SP1-JTI-FCH.2011.5.1, Project objectives**
 - “**bring hydrogen to the forefront** of the discussion on large scale energy storage [...] giving sound and clear indications to the energy actors and markets on where the advantages and the limitations are, and show with practical data **potential successful applications** of the concept”.
 - “the different storage **options in geological formations** [...] as well as the geotechnical potential **all over Europe** should be evaluated”
- **Topic SP1-JTI-FCH.2011.5.1, Other information**
 - “guarantee **robust liaison to relevant agents** of electricity and gas markets as well as engineering companies specialized in underground gas storage, including companies, system regulators (including RCS) and market regulators” -> **Guaranteed through project consortium members and “Supporting Partners”**

2. Alignment to MAIP/AIP



Priorities and topics possibly under/over-estimated in the AIPs in terms of technical challenge:

- MAIP targets demonstration of underground storage. Probably too early and too expensive in the current timeframe, but to include for the next period.



2. Alignment to MAIP/AIP



Contribution to Cross-cutting issues

- Does not apply in the sense that the project in itself belongs to Cross-cutting AA.

Information on publications:

- Initial Press Release to the media
- Web site
- 2 conferences and 6 workshops to be held during the project
- First project conference to be held on the 30th of November
- Poster presentations:
 - IPHE Workshop “Hydrogen – A competitive Energy Storage Medium to enable the large scale integration of renewable energies”, Seville, Spain, 15-16 November 2012.

2. Alignment to MAIP/AIP



Technology Transfer / Collaborations

- The consortium has built a network of collaboration through the Supporting Partners, which include relevant players in energy in Europe
 - 16 Supporting Partners up to date from:
 - Energy sector (TSO, DSO, gas, electricity...): 8 companies
 - Industrial sector: 5 companies
 - 3 Regional authorities
- Feedback is ensured and the seed is planted for next steps after the project.



2. Alignment to MAIP/AIP



Project Future Perspectives

- Opportunities for increasing cooperation and for building alliances: the goal of the project itself consists on strengthening the relationship of the energy sector in the broad sense with the (smaller) hydrogen community. Opportunities for a European approach may arise.
- Opportunities for international collaboration: the project has already attracted the attention of non European companies, which can even cooperate with information exchange.
- Possible contribution to the future FCH JU Programme: the project effectively paves the way for a real demonstration in underground storage.

To know more...

<http://www.hyunder.eu/>



Supported by:



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Thank You!!

